Remarks

This Amendment is in response to the Office Action dated **March 3, 2006.** Claims 1-23 are pending in this application. Claims 19 and 20 have been withdrawn from consideration. The Office Action rejected claims 1, 2, 5, 6, 8-10, 12-15 and 21-23 under 35 USC § 102 over Fortunko (US 4711152); rejected claims 4, 11 and 16-18 under 35 USC § 103 over Fortunko; and rejected claims 3 and 7 under 35 USC § 103 over Fortunko in view of Keil et al. (US 6176168).

By this Amendment, claims 1-3, 5, 7, 10, 15-18 and 21 are amended for clarification purposes and claims 24 and 25 added. Support for the new claims is discussed below. Applicants reserve the right to prosecute any cancelled subject matter in a subsequent patent application claiming priority to the immediate application. Claims 2, 3, 7, 10 and 15-18 are amended to replace "may be" with "is." The specification is also amended for clarification purposes. No new matter has been added. Reconsideration in view of the above amendments and the following remarks is respectfully requested.

Withdrawn Claims

The Office Action indicated that claims 29 and 20 were withdrawn. Applicant assumes the Office Action included a typographical error, and has indicated herein that claims 19 and 20 have been withdrawn. Clarification of the withdrawn claims is requested.

Specification

The specification is amended to clarify that audible and ultrasonic signals comprise mechanical signals, as opposed to electromagnetic signals. The distinction between mechanical waves and electromagnetic waves is discussed in greater detail in the Claim Rejections section below.

The specification as filed discloses transmitting setting data using an audio signal, wherein the transmitter comprises an electrodynamic speaker and the receiver comprises a microphone. This form of signal transmission clearly comprises a mechanical wave. Therefore, Applicants believe that the clarifying amendments are fully supported, and that no new matter has been added.

Claim Rejections

The Office Action rejected, under 35 USC § 102, claims 1, 2, 5, 6, 8-10, 12-15 and 21-23 over Fortunko. The Office Action also rejected, under 35 USC § 103, claims 4, 11 and 16-18 over Fortunko; and claims 3 and 7 over Fortunko in view of Keil et al. These rejections are respectfully traversed, and Applicants have further amended the claims for clarification purposes.

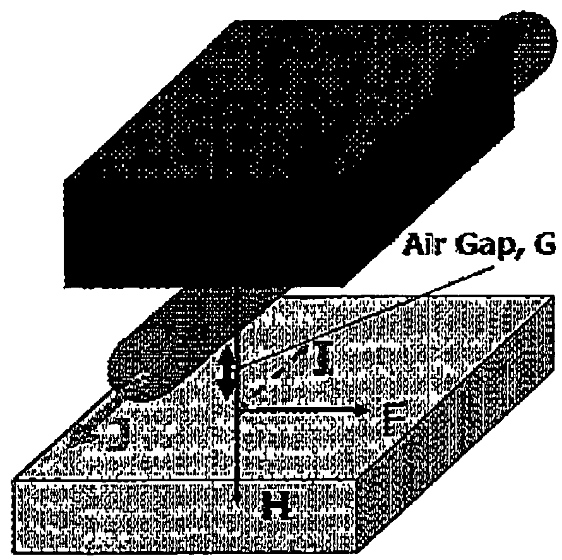
Applicants assert that Fortunko does not disclose or suggest transmission and reception of an electromagnetic signal, as required by independent claim 1. Fortunko further does not disclose or suggest a radio frequency transmitter and a radio frequency receiver, as required by independent claims 5 and 21.

Fortunko discloses the transmission of an <u>ultrasonic signal</u> using electromagnetic-acoustic transducers (EMATs). See column 2, lines 14-16.

WHAT IS AN EMAT ?

A magnet, a wire, an air gap and a metal surface.

- <u>Like an eddy current probe</u>
- <u>To transmit</u>, an alternating current in the wire, J, induces an eddy current in the metal surface, I, across the air gap, G. The magnetic field from the magnet, H, acting on I, causes a force, F, to launch a sound wave from the surface.
- <u>To receive</u>, a sound wave moves the surface in the magnetic field to generate an eddy current that induces a current, J, in the wire.



The above explanation may be found at page 2 of the document located at: <u>http://www.sonicsensors.com/EMATFundamentals.pdf</u>.

Fortunko similarly explains the EMAT theory at column 5, lines 19-56.

A person of ordinary skill in the art would understand that the transmitting EMAT

disclosed in Fortunko induces an <u>ultrasonic sound wave</u> into the metal conductor (i.e. the gun tube). Thus, the transmitting EMAT induces a physical vibration into the metal conductor. The receiving EMAT receives the physical vibration (i.e. the ultrasonic sound wave).

Applicants have also attached copies of pages 455 and 479 from Serway, Raymond A., 1996, Physics for Scientists & Engineers with Modern Physics, Fourth edition, published by Harcourt Brace & Company, Orlando, FL.

The Physics text distinguishes between mechanical waves, which require a physical medium, and electromagnetic waves, which do not require a medium in order to propagate. See page 455, second paragraph. The text further explicitly states that ultrasonic waves are mechanical waves having frequencies above the audible range. See page 479, second paragraph.

A person of ordinary skill in the art would understand that the ultrasonic signal transmitted by the Fortunko EMAT is a mechanical wave, and not an "electromagnetic signal" as required by claim 1. Figure 5 of Fortunko, provided below, depicts the ultrasonic mechanical wave being transmitted using the gun tube as the required physical medium. Fortunko further discloses that an air gap [for example as shown in Figure 5, below] of approximately ½ millimeter will produce "only a 50% reduction in signal strength." See column 6, lines 13-16

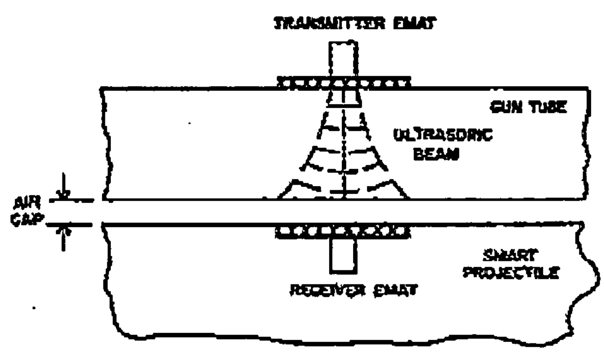


FIG. 5

If the Fortunko signal were an electromagnetic signal, and therefore a signal that would not require a physical medium, the strength of the signal would not be expected to be reduced by 50% when crossing an air gap of ½ millimeter.

Thus, Applicants assert that Fortunko does not disclose or suggest setting data being "transmitted from the transmitter to the receiver via an electromagnetic signal" as recited in

BEST AVAILABLE COPY

independent claim 1. Therefore, Applicants assert that Fortunko does not disclose or suggest all of the limitations of claim 1, and that claim 1 is patentable over Fortunko.

A person of ordinary skill in the art would further understand that a Fortunko EMAT does not comprise a radio frequency transmitter or a radio frequency receiver, as required by independent claims 5 and 21. Therefore, Applicants assert that Fortunko does not disclose or suggest all of the limitations of claims 5 or 21, and that claims 5 and 21 are also patentable over Fortunko.

Keil et al. was applied for the teaching of a talkback signal being transmitted from the fuze back to the fuze setter, and is not believed to impact the patentability of independent claims 1, 5 or 21.

Claims 2-4, 6-18, 22 and 23 each comprises a dependent claim that depends, directly or indirectly, from one of independent claims 1, 5 or 21. Each dependent claim is patentable for at least the reasons discussed with respect to the independent claim from which it depends. Accordingly, Applicants respectfully request the withdrawal of the rejections under 35 USC § 102 and 35 USC § 103.

New Claims

New claims 24 and 25 are added. Claim 24 is similar to original claim 1 but does not explicitly specify a number of bands of the electromagnetic spectrum. Therefore, new claim 24 is believed to be supported at least by original claim 1.

New claim 25 specifies a frequency range for the electromagnetic signal of claim 24. The claimed frequency range only includes frequencies that are encompassed by the bands explicitly listed in original claim 1: radio-frequency, infrared, visible and ultraviolet. Therefore, new claim 25 is believed to be supported at least by original claim 1. Applicants have further attached page 1012 of the aforementioned Serway Physics text, which shows the claimed frequency range in conjunction with the associated bands of the electromagnetic spectrum. See Figure 34.17.

Conclusion

Based on at least the foregoing amendments and remarks, Applicants respectfully submit this application is in condition for allowance. Favorable consideration and prompt allowance of claims 1-18 and 21-25 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in better condition for allowance, the Examiner is invited to contact Applicants' undersigned representative at the telephone number listed below.

Respectfully submitted,

VIDAS, ARRETT & STEINKRAUS

Date: June 5, 2006

By: ______________________
Jeremy G. Laabs
Registration No.: 53170

6109 Blue Circle Drive, Suite 2000
Minnetonka, MN 55343-9185
Telephone: (952) 563-3000
Facsimile: (952) 563-3001

f:\wpwork\jgl\11304us01_amd_20060530.doc

PHYSICS

For Scientists & Engineers with Modern Physics

Fourth Edition

Raymond A. Serway

James Madison University

SAUNDERS GOLDEN SUNBURST SERIES

SAUNDERS COLLEGE PUBLISHING

Philadelphia Fort Worth Chicago San Francisco
Montreal Toronto London Sydney Tokyo

A bit of gossip starting in Washington reaches New York very quickly, even though not a single individual who takes part in spreading it travels between these two cities. There are two quite different motions involved, that of the rumor, Washington to New York, and that of the persons who spread the rumor. The wind, passing over a field of grain, sets up a wave which spreads out across the whole field. Here again we must distinguish between the motion of the wave and the motion of the separate plants, which undergo only small oscillations. . . . The particles constituting the medium perform only small vibrations, but the whole motion is that of a progressive wave. The essentially new thing here is that for the first time we consider the motion of something which is not matter, but energy propagated through matter.

Water waves and the waves across a grainfield are only two examples of physical phenomena that have wavelike characteristics. The world is full of waves, the two main types of which are mechanical waves and electromagnetic waves. We have already mentioned examples of mechanical waves: sound waves, water waves, and grain waves." In each case, there is some physical medium being disturbed—air molecules, water molecules, and stalks of grain in our three particular examples. Electromagnetic waves are a special class of waves that do not require a medium in order to propagate, some examples being visible light, radio waves, television signals, and x-rays. Here in Part II of this book, we shall study only mechanical waves.

The wave concept is abstract. When we observe what we call a water wave, what we see is a rearrangement of the water's surface. Without the water, there would be no wave. A wave traveling on a string would not exist without the string. Sound waves travel through air as a result of pressure variations from point to point. In such cases involving mechanical waves, what we interpret as a wave corresponds to the disturbance of a body or medium. Therefore, we can consider a wave to be the *motion of a disturbance.*

The mathematics used to describe wave phenomena is common to all waves. In general, we shall find that mechanical wave motion is described by specifying the positions of all points of the disturbed medium as a function of time.

16.1 INTRODUCTION

The mechanical waves discussed in this chapter require (1) some source of disturbance, (2) a medium that can be disturbed, and (3) some physical connection through which adjacent portions of the medium can influence each other. We shall find that all waves carry energy. The amount of energy transmitted through a medium and the mechanism responsible for that transport of energy differ from case to case. For instance, the power of ocean waves during a storm is much greater than the power of sound waves generated by a single human voice.

Three physical characteristics are important in characterizing waves: wavelength, frequency, and wave speed. One wavelength is the *minimum distance between any two points on a wave that behave identically,* as shown in Figure 16.1.

Most waves are periodic, and the frequency of such periodic waves is *the time rate at which the disturbance repeats itself.*

Waves travel with a specific speed, which depends on the properties of the medium being disturbed. For instance, sound waves travel through air at 20°C with a speed of about 344 m/s (781 mi/h), whereas the speed of sound in most solids is higher than 344 m/s. Electromagnetic waves travel very swiftly through a vacuum with a speed of approximately 3.00×10^8 m/s (186 000 mi/s).

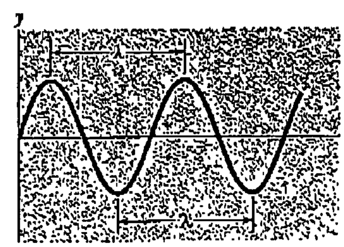


FIGURE 16.1 The wavelength λ of a wave is the distance between adjacent crests or adjacent troughs.

Sound Waves

Fennec foxes are small animals with very large ears, about four inches long. The sensitivity of their auditory system is enchanced by these large ears, which enable them to hear very faint sounds as they collect a larger cross-section of sound waves. (Tom McHugh/Photo Researchers)

Sound waves are the most important example of longitudinal waves. They can travel through any material medium with a speed that depends on the properties of the medium. As the waves travel, the particles in the medium vibrate to produce density and pressure changes along the direction of motion of the wave. These changes result in a series of high- and low-pressure regions called *condensations* and *rarefactions*, respectively. If the source of the sound waves vibrates sinusoidally, the pressure variations are also sinusoidal. We shall find that the mathematical description of harmonic sound waves is identical to that of harmonic string waves discussed in the previous chapter.

There are three categories of mechanical waves that cover different ranges of frequency: (1) *Audible waves* (usually called sound waves) are waves that lie within the range of sensitivity of the human ear, typically, 20 Hz to 20 000 Hz. They can be generated in a variety of ways, such as by musical instruments, human vocal cords, and loudspeakers. (2) *Infrasonic waves* are waves having frequencies below the audible range. Earthquake waves are an example. (3) *Ultrasonic waves* are waves having frequencies above the audible range. For example, they can be generated by inducing vibrations in a quartz crystal with an applied alternating electric field. All may be longitudinal or transverse in solids but only longitudinal in fluids.

Any device that transforms one form of power into another is called a *transducer*. In addition to the loudspeaker (which transforms electric power to power in audible waves) and the quartz crystal (electric power to ultrasonic power), ceramic and magnetic phonograph pickups are common examples of sound transducers.

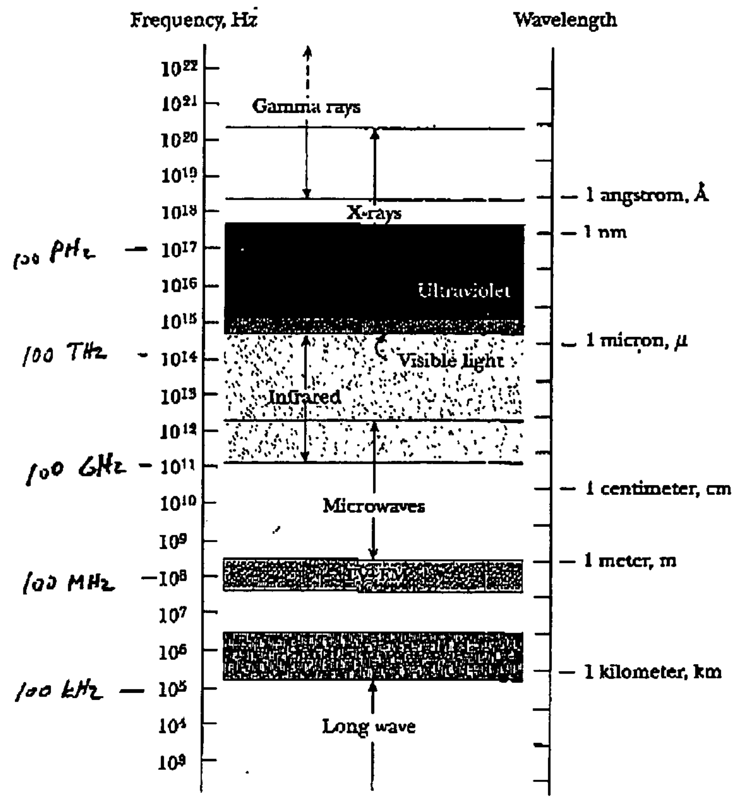


FIGURE 34.17 The electromagnetic spectrum. Note the overlap between adjacent wave types.

ing the atomic and molecular properties of matter. Microwave ovens represent an interesting domestic application of these waves. It has been suggested that solar energy could be harnessed by beaming microwaves down to Earth from a solar collector in space.[8]

Infrared waves

Infrared waves (sometimes called heat waves) have wavelengths ranging from approximately 1 mm to the longest wavelength of visible light, 7×10^{-7} m. These waves, produced by hot bodies and molecules, are readily absorbed by most materials. The infrared energy absorbed by a substance appears as heat because the energy agitates the atoms of the body, increasing their vibrational and rotational motion, which results in a temperature rise. Infrared radiation has many practical and scientific applications, including physical therapy, infrared photography, and vibrational spectroscopy.

Visible waves

Visible light, the most familiar form of electromagnetic waves, is that part of the electromagnetic spectrum that the human eye can detect. Light is produced by the rearrangement of electrons in atoms and molecules. The various wavelengths of visible light are classified with colors ranging from violet ($\lambda \approx 4 \times 10^{-7}$ m) to red ($\lambda \approx 7 \times 10^{-7}$ m). The eye's sensitivity is a function of wavelength, the sensitivity being a maximum at a wavelength of about 5.6×10^{-7} m (yellow-green).

Ultraviolet waves

Ultraviolet light covers wavelengths ranging from approximately 3.8×10^{-7} m (380 nm) down to 6×10^{-8} m (60 nm). The Sun is an important source of ultravi

[8] P. Glaser, "Solar Power from Satellites," *Physics Today*, February, 1977, p. 30.